NAVWEPS 16-45-75

HANDBOOK

Operation • Service and Overhaul Instructions with Illustrated Parts Breakdown

TRANSISTOR-DIODE TESTER MODEL NO. 219Z

(Sierra Electronic Division
of Philco Corporation)

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THE BUREAU OF NAVAL WEAPONS

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TABLE OF CONTENTS

Section		Page
I	INTRODUCTION AND DESCRIPTION	1
1-1.	Purpose of Handbook	1
1-4.	Purpose of Equipment	1
1-8.	Description of Equipment	1
1-10.	Principles of Operation	2
1-11.	General	2
1-19.	1.125-KC Reference Signal Source	3
1-22.	2.25-KC Tuned Amplifier	4
1-25.	Electronic Switch	4
1-27.	Leakage-Current Test Circuit	4
II	SPECIAL SERVICE TOOLS	6
III	PREPARATION FOR USE, STORAGE, OR SHIPMENT	6
3-1.	Preparation for Use	6
3-2.	Initial Inspection	6
3-4.	Installing Batteries	6
3-6.	Preparation for Storage or Shipment	6
IV	OPERATION INSTRUCTIONS	6
4-1.	General	6
4-3.	Battery Checkout	6
4-4.	In-Circuit Transistor Beta Tests	6
4-6.	Out-of-Circuit Beta Tests	8
4-8.	Leakage-Current Tests	8
4-11.	Diode Tests	9
V	PERIOD INSPECTION, MAINTENANCE AND LUBRICATION	9
5-1.	Scope of Section	9
5-3.	Periodic Inspection	9
5-5.	Maintenance	9
5-7.	Lubrication	9
VI	TROUBLESHOOTING	10
6-1.	Scope of Section	10
6-3.	Troubleshooting	10
6-6.	Calibration	10
6-7.	General	10
6-9.	Test Equipment Required	10
6-11.	Step-by-Step Procedure	10
VII	OVERHAUL INSTRUCTIONS	11
7-1.	Scope of Section	11
7-3.	Disassembly	11
7-5.	Reassembly	11
VIII	INTRODUCTION TO ILLUSTRATED PARTS BREAKDOWN	11
8-1.	General	11
8-4.	Group Assembly Parts List (Section IX)	11
8-6.	Figure and Index Number Column	11
8-8.	Part Number Column	12
8-11.	Description Column	12
8-15.	Units Per Assembly Column	12
8-17.	Usable on Code Column	12
8-19.	Numerical Index (Section X)	12
8-21.	Part Number Column	12
8-23.	Stock Number Column	12
8-25.	Figure and Index Number Column	13
8-27.	Source Code Column	13
8-29.	Recoverability Code Column	13
8-31.	Explanation of Source Codes	13
8-33.	Definition of Maintenance Code	13
8-35.	Definition of Recoverability Code	13
8-37.	Code Format	14
8-39.	Government Standard Parts	14
8-41.	Reference Designation Index (Section XI)	14
8-43.	Reference Designation Column	14
8-45.	Figure and Index Number Column	14
8-47.	Stock Number Column	14
8-49.	Part Number Column	14
8-51.	Vendors' Codes, Names, and Addresses	14
IX	GROUP ASSEMBLY PARTS LIST	16
X	NUMERICAL INDEX	27
XI	REFERENCE DESIGNATION INDEX	28

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Transistor-Diode Tester, Model 219Z, Front View	iii
1-2	Transistor-Diode Tester, Model 219Z, Simplified Schematic Diagram	3
1-3	Transistor-Diode Tester, Model 219Z, Schematic Diagram	5
9-1	Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 1 of 5, Index No. 1 thru 33)	17
9-1	Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 2 of 5, Index No. 34 thru 63)	19
9-1	Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 3 of 5, Index No. 64 thru 100)	21
9-1	Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 4 of 5, Index No. 101 thru 138)	23
9-1	Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 5 of 5, Index No. 139 thru 153)	25

LIST OF TABLES

Table		Page
I	Transistor-Diode Tester, Model 219Z, Specifications	1
II	Operating Controls and Indicators	7

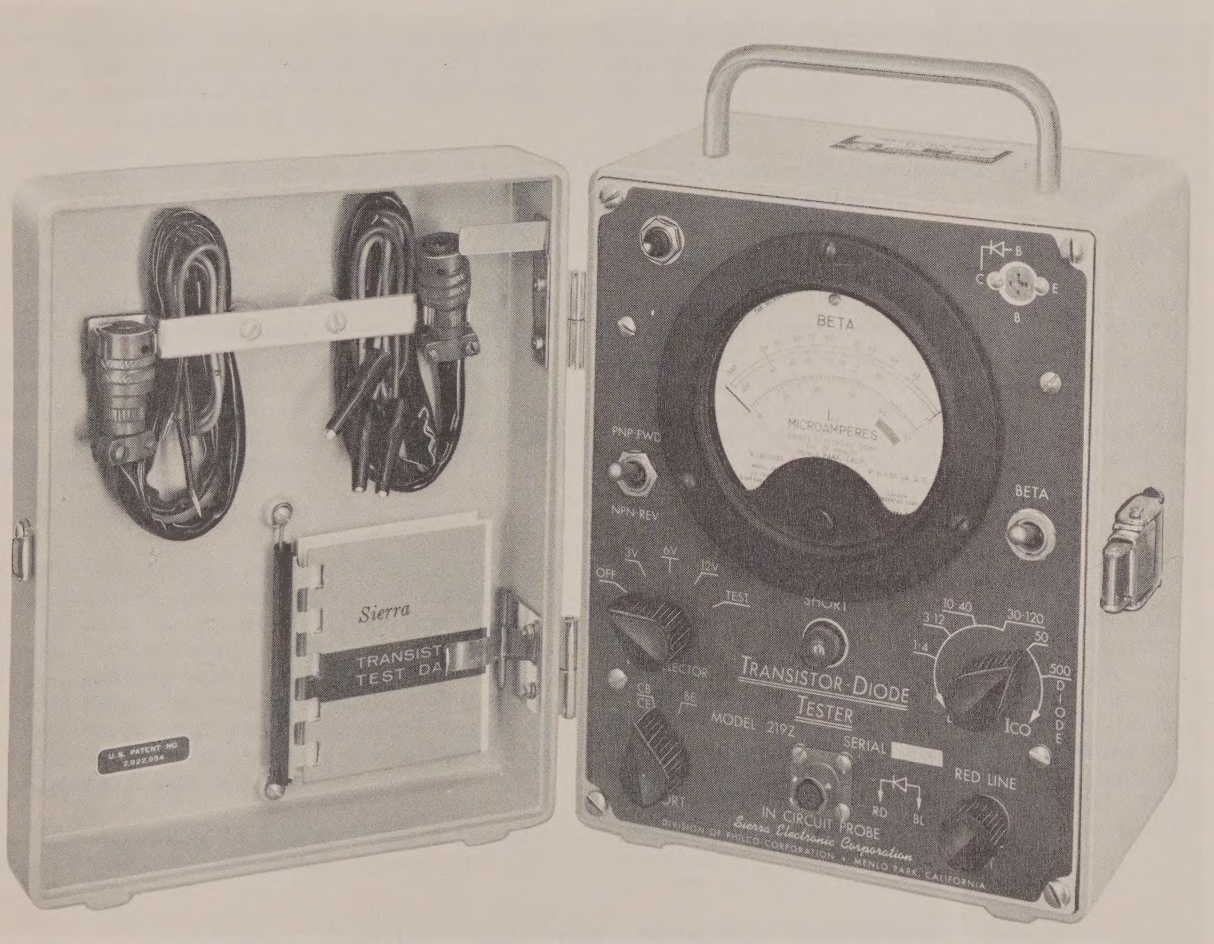

Figure 1-1. Transistor-Diode Tester, Model 219Z, Front View

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. PURPOSE OF HANDBOOK.

1-2. This handbook contains operation and service instructions and an Illustrated Parts Breakdown for Transistor-Diode Tester, Model 219Z. There are no applicable TCTO's.

1-3. This handbook comprises eleven sections. Section I introduces the transistor-diode tester and describes it physically and functionally; Section II discusses special service tools used for maintenance and overhaul of the tester; Section III lists the steps necessary to prepare the tester for use, storage, or shipment; Section IV contains operation instructions; Section V provides maintenance instructions; Section VI covers troubleshooting; Section VII contains overhaul instructions. Sections VIII, IX, X, and XI present an Illustrated Parts Breakdown.

1-4. PURPOSE OF EQUIPMENT.

1-5. The transistor-diode tester (figure 1-1) is a self-contained, portable instrument that measures the beta parameter of a transistor with the transistor connected in a circuit and leakage current (I_{CO}) and beta parameters with the transistor removed from the circuit. Because of the low current levels employed to measure beta and I_{CO}, the tester is particularly useful for testing low-signal transistors.

1-6. The capability of this instrument to make in-circuit beta measurements arises from its ability to discriminate between a special test signal and spurious signals flowing in the circuit of the transistor under test. In addition, low-impedance measurement techniques reduce readout errors that might occur with low resistances in the external circuit.

1-7. The tester measures beta with an error not greater than ±20 percent if the circuit impedance at the emitter-base and emitter-collector transistor terminals is 500 ohms or higher. (External d-c resistances below 500 ohms will cause a warning lamp to light.) However, because most conventional transistor circuits have terminal resistances much higher than 500 ohms, the probable accuracy is considerably better than ±20 percent; also, though the d-c resistance may be less than 500 ohms, the reactance may be much greater, resulting in an accuracy equal to or better than ±20 percent.

1-8. DESCRIPTION OF EQUIPMENT.

1-9. The tester is housed in a plastic case which has a handle for convenient transporting. Two three-prod test cables and a booklet that contains transistor test data are stored in the front cover of the case. The transistor tester is shipped from the factory with mercury batteries. When the tester cover is closed, the battery supplies are automatically disconnected. The technical specifications of the tester are listed in table I.

Table I. Transistor-Diode Tester, Model 219Z, Specifications

Test Ranges:	Beta: 1 to 4, 3 to 12, 10 to 40, 30 to 120, approximation to 300
	I_{CO}: 0 to 50 microamperes and 0 to 500 microamperes
Beta Accuracy:	In-circuit tests: Maximum ±20% error for external resistive loads of 500 ohms across emitter-collector and emitter-base terminals. Typical circuit tests are in error about ±5%.
	Out-of-circuit tests: 10% maximum error
Transistor and Semi-Conductor Complement:	4 each, type 2N404 transistors 3 each, type 2N527 transistors 1 each, type 1N191 diode
Operating Temperature:	32°F to 149°F (0°C to 65°C)

Table I. Transistor-Diode Tester, Model 219Z, Specifications (Continued)

Power Requirements:	The transistor tester contains two separate, 12-volt battery supplies. One provides power for the internal tester circuits, and the other furnishes collector voltage for the transistor under test. Six-hundred operating hours of life may be expected under normal conditions.	
Input Connections:	In-circuit transistors are tested by either of two, three-prod test cables. The prods of one cable are small, insulated spade clips and the prods of the other cable are miniature alligator clips. The leads of both test cables are color coded and alphabetically identified, C-collector, E-emitter, and B for base. Out-of-circuit transistors may be tested by using either a test cable or the transistor socket on the front panel.	
Over-All Dimensions:	10 inches by 7-5/8 inches by 6-1/2 inches	
Weight:	Shipping:	13 pounds
	Operating:	10-1/4 pounds including batteries.

1-10. PRINCIPLES OF OPERATION.

1-11. GENERAL.

1-12. Figure 1-2 is a simplified schematic diagram of the tester when measuring beta. The transistor beta parameter is defined as the current gain of a common-emitter transistor configuration and is expressed by the equation

$$B = \frac{\triangle I_c}{\triangle I_b}$$

where

B = beta
$\triangle I_c$ = change in collector current caused by a change in base current
$\triangle I_b$ = change in base current

1-13. When measuring beta of a transistor removed from the circuit, conventional a-c or d-c current measurements are sufficient. However, when measuring the beta of a transistor connected in the circuit, these methods are inadequate because of currents in the collector or base, or both, that are not attributable to transistor conduction. These currents result from resistances and reactances that are an integral part of the circuit, shunting the emitter-base and emitter-collector junction. The transistor-diode tester employs a method that eliminates erroneous readings caused by these sneak paths. When an a-c signal is applied to the base of a common-emitter circuit operating class B, conduction of the transistor results in high second-harmonic content in the base and collector currents; the magnitudes of these second-harmonic currents are directly related to transistor conduction (and thus beta) and has no relation to any sneak currents (which would have a frequency equal to the fundamental). By measuring the relative values of the second-harmonic base and collector currents, and applying the beta equation, an accurate determination of beta can be made.

NOTE

Another diode or transistor in the external base circuit can introduce an erroneous second-harmonic current and consequently cause an excessive error in beta measurements. (See operating portion of this manual.)

1-14. From the basic beta equation, if I_c is equal to one unit, beta would equal

$$B = \frac{1}{\triangle I_b}$$

or beta would be inversely proportional to $\triangle I_b$. In the tester, the collector current of the transistor under test is set to an average collector current of 1 milliampere, and then the base current is measured. The readout meter is calibrated in terms of beta as an inverse function of the current through the meter.

1-15. As shown in figure 1-2, a 1.125-kc reference signal is applied to the base-emitter junction of the test transistor. The 2.25-kc (second harmonic) tuned amplifier is switched across collector load resistor R28, and the reference signal is adjusted for 1-milliampere (red line on readout meter) average d-c collector current. The tuned amplifier is then switched across the series base resistor (R_b) and the readout meter indicates the value of beta.

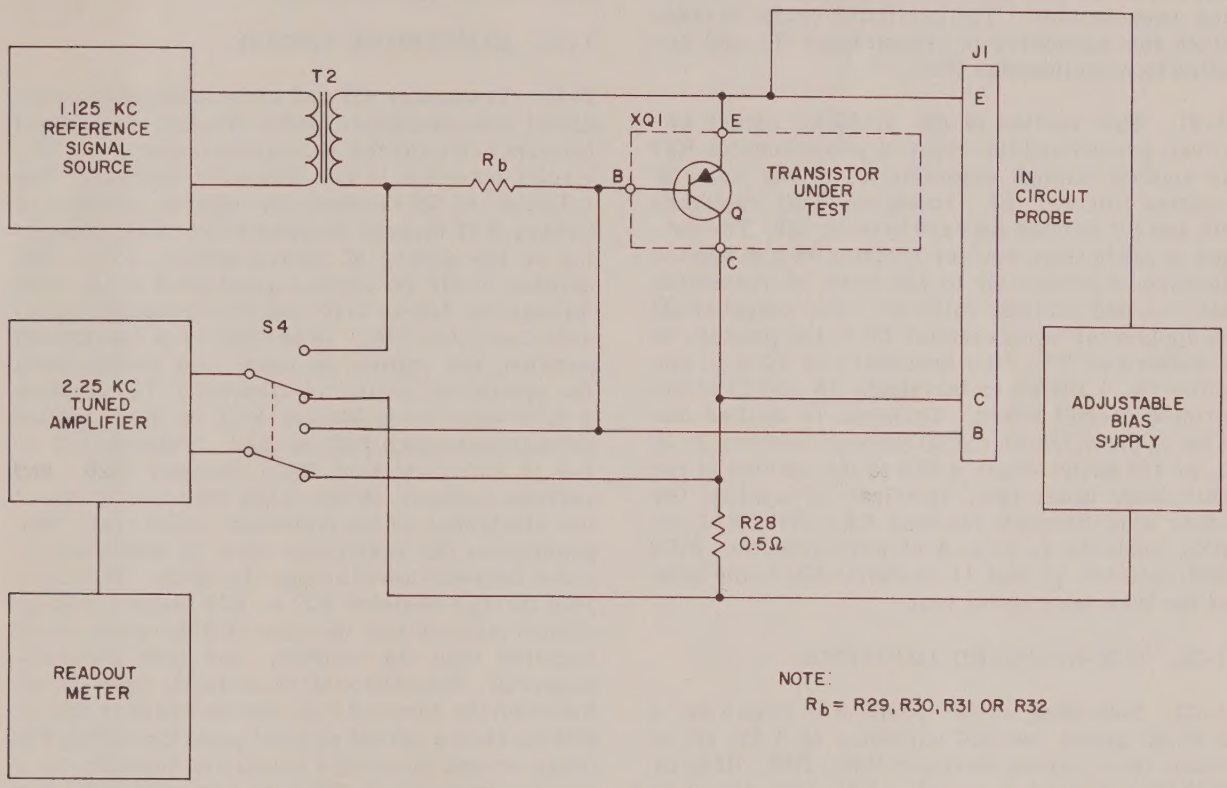

Figure 1-2. Transistor-Diode Tester, Model 219Z, Simplified Schematic Diagram

1-16. For the transistor tester to retain its specified accuracy, the impedance loading across the emitter-base and emitter-collector junctions of the test transistor must be 500 ohms or greater. In the event this d-c resistance requirement is not met, a front-panel warning lamp indicates the presence of this low-resistance shunt path; but if an impedance of 500 ohms or more is present, the specified accuracy is retained regardless of the lighted lamp. This same warning lamp also indicates a shorted transistor.

1-17. The readout meter (minus its associated amplifier) measures transistor leakage current (I_{CO}) when the transistor is disconnected from the circuit. This facility provides an additional check on transistor degradation.

NOTE

Because of d-c shunt paths, do not measure I_{CO} when the test transistor is in the circuit.

1-18. In operation, an appropriate d-c voltage in series with the readout meter is applied to the collector-base junction, and the emitter circuit is opened. Collector-to-base leakage current is then read on the readout meter. To prevent damage to the readout meter, a series resistor is included in the circuit; consequently, this resistor is in series with the collector-base junction resistance and causes a small error in I_{CO}, the extent of the error depending on the relative resistance values. As I_{CO} becomes greater (less base-collector junction resistance) the error becomes greater, but for most cases the error is less than 5 percent.

1-19. 1.125-KC REFERENCE SIGNAL SOURCE.

1-20. Transistor Q1 (figure 1-3) and associated components form a Hartley oscillator. The frequency of oscillation is controlled by capacitor C3 and the inductance of the primary of transformer T1. Positive feedback from pin 1 of T1 is applied through resistor R5 and capacitor C1 to the base of Q1. The base of Q1 is forward-

biased by the voltage taken from the voltage-divider network R1 and R2. Resistor R3 and capacitor C2 provide a small amount of stabilizing reverse bias. The oscillator output is taken from the secondary of transformer T1 and applied to potentiometer R27.

1-21. That portion of the 1.125-kc signal between ground and the wiper of potentiometer R27 is applied through capacitor C4 to the base of emitter follower Q2. Voltage-divider resistors R6 and R7 provide forward bias for Q2. The output is taken from emitter resistor R8 and applied through capacitor C5 to the base of transistor Q3, another emitter follower. The output of Q3 is applied through capacitor C6 to the primary of transformer T2. The secondary of T2 then applies the 1.125 kc to terminals 14 and 15 of the printed circuit board. Terminal 14 applies one side of the 1.125-kc signal through contacts 1, 2, 3, or 4 of switch-section S1A to the emitter of the transistor under test; terminal 15 applies the other side (through resistor R29, R30, R31, or R32; contacts 1, 2, 3, 4 of switch-section S1C; and contacts 10 and 11 of switch S2) to the base of the transistor under test.

1-22. 2.25-KC TUNED AMPLIFIER.

1-23. Depending on the position of switch S4, a 2.25-kc signal (second harmonic of 1.125 kc) is taken from across resistor R29, R30, R31, or R32 (R_b) or across resistor R28; this signal is applied through the 2.25-kc series-resonant circuit, which readily passes 2.25 kc but rejects the 1.125 kc. The voltage divider (R12, R13) connected from collector to ground provides Q4 negative feedback for stabilization purposes. The output of Q4 is taken from the wiper of potentiometer R14 (which serves as the collector load resistor) and applied through capacitor C8 to the base of common-emitter voltage amplifier Q5. The 2.25-kc parallel-resonant circuit (composed of C10 and L2) provides a high-impedance base circuit for 2.25 kc, but short-circuits other frequencies to ground. Capacitor C11 is a d-c blocking capacitor. The output of Q5 is taken from the collector and applied to the base of transistor Q6. Voltage amplifier Q6 is identical with Q5 except for component values.

1-24. The signal at the collector of Q6 is applied through capacitor C16 to diode CR1. This diode conducts on the negative cycles of the signal, and the resulting current is applied through contacts 7-9 or 7-10 of switch-section S5A to the 1, 2, 3, or 4 contacts of switch-section S1B. These contacts in turn apply the d-c current through meter M1 to the 7, 8, 9, or 10 contacts of switch-section S1B and then to ground.

1-25. ELECTRONIC SWITCH.

1-26. Transistor Q7 and associated components detect low-resistance paths through or around (external circuit) the transistor under test. The circuit operates in the following manner: The collector of Q7 receives the negative common of battery BT1 through resistor R33 or R34, depending on the setting of switch-section S5A. The emitter of Q7 receives a positive 3 or 6 volts through the 7-9 or 7-10 contacts (respectively) of switch-section S5C. (When S5C is in the 12-volt position, the emitter is open, and consequently the electronic switch is disabled.) The positive 3 or 6 volts from battery BT1 is also applied through resistors R37 or R38, contacts 1-3 or 1-4 of switch-section S5C, resistor R26, and various contacts of the other switches to one of the electrodes of the transistor under test. Depending on the resistance seen by this voltage, a d-c current flows through this path. This current through resistor R37 or R38 drops a voltage of such polarity that the base of Q7 becomes more negative than its emitter, and thus forward-biases Q7. Transistor Q7 is normally near cutoff, but when the forward bias across resistor R37 or R38 reaches a preset critical point (indicating 500 ohms or less shunting a transistor junction, or a shorted transistor), Q7 goes into conduction and lights SHORT lamp DS1.

1-27. LEAKAGE-CURRENT TEST CIRCUIT.

1-28. When measuring I_{CO}, the emitter of the test transistor is opened by contact 5 or 6 of switch-section S1A, the collector (if the transistor is a PNP type) is brought through switches S2 and S3 to the negative side of battery BT1, and the emitter is applied to meter M1 through switch S2 and various contacts of switch S1. Depending on whether the 50- or 500-microampere range is being used, the meter is then returned through meter-protection resistors R35 or R39 and then connected to the positive side of BT1 through resistors R26, and R37 or R38 (depending on the position of BIAS SELECTOR switch S5). The meter records the leakage current. If the voltage developed across resistor R37 or R38 is large enough, the electronic switch operates and a short is indicated. When in the 500-microampere position, switch S1 connects meter shunt R36 across meter M1, which changes the meter range from a basic 50 microamperes to 500 microamperes.

Table II. Operating Controls and Indicators

Panel Marking	Description	Function
SHORT	Amber indicator lamp	Indicates shorted transistor. When in-circuit transistors are tested, this lamp also indicates that surrounding circuit presents resistive load of less than 500 ohms between E-B or E-C.
E-B-C-B	Miniature socket	Receptacle for out-of-circuit-test transistors and diodes.
PNP-FWD NPN-REV	Two-position toggle switch	Selects polarity of collector and emitter bias for transistor under test.
BETA	Two-position toggle switch	In down position (momentary), permits readout of beta.
Readout Meter	Circular, 0 to 50 d-c microampere meter	(1) BETA scales indicate magnitude of transistor beta. (2) I_{CO} scales indicate magnitude of leakage current. (3) Green band used when testing batteries BT2, 3, 4, 5, 6 and 7. (4) Red line used when adjusting output of reference signal source.
SHORT: BE, CB-CE	Two-position rotary switch	(1) CB-CE position tests for short circuit or low resistance across collector-base or collector-emitter. (2) BE position (momentary) tests for short circuit or low resistance across base-emitter.
BIAS SELECTOR: OFF, 3V, 6V, 12V, TEST	Five-position rotary switch	(1) OFF position removes all voltage from collector of transistor under test and tester transistors. (2) 3V, 6V and 12V positions apply corresponding voltage to collector of test transistor. Checks BT1, using external meter. (3) TEST position checks batteries BT2, 3, 4, 5, 6 and 7.
BETA ICO	Six-position rotary switch	Beta, I_{CO} and diode range switch.
RED LINE SET	Potentiometer	Permits adjustment of internal test signal.
IN CIRCUIT PROBE	Three-prong female connector	Receptacle for three-prod test cable.
None	Two-position pushbutton switch (S6)	Disconnects battery supply when tester cover is closed.

c. Set BIAS SELECTOR switch to OFF.

d. Set PNP-FWD NPN-REV switch to transistor type.

e. Set SHORT switch to CB/CE position.

f. Connect test cable to receptacle on panel. Connect the three prods of the test cable to the proper terminals of transistor.

g. Set BIAS SELECTOR switch to 3V position. If SHORT lamp glows there may be external circuit loads across either the base-collector terminals or the collector-emitter terminals. (Proceed with the test, remembering that beta may be in error by more than 20 percent.)

h. Set SHORT switch to BE position. If SHORT lamp glows there may be an external circuit load across the base-emitter terminals. (Proceed with the tests, remembering that beta may be in error by more than 20 percent.)

i. Set BIAS SELECTOR switch to proper collector voltage for test transistor.

j. Adjust RED LINE SET until needle coincides with red line. If needle cannot be adjusted to red line and if SHORT lamp does not glow, the transistor is probably faulty. If needle cannot be adjusted to red line, but if SHORT lamp does glow, either the transistor is shorted or there may be very low resistances in the external circuit.

k. Place BETA switch in down position and observe value on readout meter. If beta does not read on scale, select a range so that the reading is in the calibrated section of the scale. If possible, try not to use the extreme left-hand portion of the scale. Compare reading with minimum value given in table I of test data booklet. If reading is below that indicated in the table, the transistor is defective.

NOTE

If beta is less than the lowest acceptable limit and the test transistor has a transistor or diode in its base circuit, isolate the base lead and recheck beta.

l. Set BIAS SELECTOR switch to OFF position.

4-6. OUT-OF-CIRCUIT BETA TESTS.

4-7. Before testing the transistor, refer to test data booklet mounted in front cover of tester. Table II of the booklet illustrates the base connections of common transistors. Table I of the booklet lists the test parameters for each transistor. Select the entry corresponding to the transistor to be tested and proceed as follows:

a. Set the BETA I_{CO} switch to the appropriate beta range.

b. Set BIAS SELECTOR switch to OFF.

c. Set PNP-FWD NPN-REV switch to transistor type.

d. Set SHORT switch to CB/CE position.

e. Insert transistor leads into proper prongs of EBCB socket. (If the three-prod test cable is connected, clip each prod to the proper transistor lead.)

NOTE

Do not try to test two transistors simultaneously by leaving one in the EBCB socket and connecting the other to the test prods.

f. Set BIAS SELECTOR switch to 3V position. If SHORT lamp glows, the transistor is shorted and no further tests are necessary.

g. Set SHORT switch to BE position. If SHORT lamp glows, the transistor is shorted and no further tests are necessary.

h. Set BIAS SELECTOR switch for proper collector voltage for test transistor.

i. Adjust RED LINE SET control until needle coincides with red line. If the needle cannot be adjusted to the red line, the transistor is faulty and no further tests are necessary.

j. Place BETA switch in down position and read beta value on the readout meter. If possible, try not to use the extreme left-hand portion of the scale. Compare reading with minimum value given in table I of test data booklet. If reading is below that given in the table, the transistor is defective.

k. Set BIAS SELECTOR switch to OFF position.

4-8. LEAKAGE-CURRENT TESTS.

4-9. Since the leakage current (I_{CO}) of a transistor is measured on a direct-current basis, any alternate current paths through the external circuit create measurement errors. In view of this condition, in-circuit leakage tests are not recommended.

CAUTION

Do not let the test prods touch each other during the leakage test.

4-10. To measure leakage current, refer to paragraph 4-7 and perform steps c through h. Then turn the BETA I_{CO} switch to the 50-microampere range and read I_{CO} on the readout meter. If I_{CO} exceeds 50 microamperes, switch to the 500-microampere range. If I_{CO} exceeds the value given in table I of the test data booklet, the transistor is defective. Restore controls to their OFF positions.

4-11. DIODE TESTS.

a. Connect diode under test to base and collector terminals of panel socket (anode to B, cathode to C); or, if desired, use test cable rather than socket (anode to blue, cathode to red). BIAS SELECTOR switch should be in OFF position.

b. Set BETA I_{CO} switch to 50 microampere I_{CO}/DIODE position, and place PNP-FWD NPN-REV switch to PNP-FWD position.

c. Set BIAS SELECTOR switch to 3V position, and read forward diode current. If current is over 50 microamperes, use 500 microampere range of BETA I_{CO} switch.

d. Place PNP-FWD NPN-REV switch in NPN-REV position, and read diode reverse current.

SECTION V

PERIODIC INSPECTION, MAINTENANCE, AND LUBRICATION

5-1. SCOPE OF SECTION.

5-2. This section describes procedures and precautionary measures to be used in maintaining reliable operation of the transistor-diode tester. The information is presented in three parts: periodic inspection, maintenance, and lubrication.

5-3. PERIODIC INSPECTION.

5-4. The tester should be inspected each time it is used or inspected daily if used continually. Conduct the periodic inspection as follows:

a. Observe panel for damage to knobs, switches, or meter face.

b. Ensure that knobs of rotary switches are tight and that the switches operate in all positions.

c. Set BIAS SELECTOR switch to TEST position; verify that meter indicates in green region. If indication is abnormal, replace batteries BT2 through BT7. (Refer to paragraph 7-3 for disassembly instructions.)

d. Inspect the two cable assemblies; verify that connectors, clips, and cables are undamaged.

e. Inspect test data booklet for damaged or missing pages.

f. Ensure that the four screws holding panel to case are secure.

g. Inspect cover latch and hinges for damage. Verify that cover is closed tightly when latched.

5-5. MAINTENANCE.

5-6. Preventive maintenance required for the transistor-diode tester is limited to performing the following steps each time the instrument is used:

a. Clean exterior surfaces of tester with lint-free cloth dampened with water.

b. If required, clean meter face with lens tissue.

5-7. LUBRICATION.

5-8. The transistor-diode tester requires no lubrication.

SECTION VI

TROUBLESHOOTING

6-1. SCOPE OF SECTION.

6-2. This section contains general information for troubleshooting Transistor-Diode Tester, Model 219Z. The tester requires calibration after being serviced; calibration instructions are therefore included in this section.

6-3. TROUBLESHOOTING.

6-4. On instruments of this type, the likely sequence of parts failure should be (a) weak or dead batteries, (b) mechanical failure of test leads and frequently adjusted controls, (c) transistor failure, (d) leaky or shorted capacitors, or (e) defective resistors. It should be noted that the failure of one part may allow the current to become excessive and damage other parts.

6-5. Since this instrument is of simple design, no elaborate troubleshooting procedures are required. If a malfunction is suspected, isolate the cause of the malfunction to one of the functional groups of component parts: main power batteries, bias battery, SHORT indicating circuit, 1.125-kc reference signal source and 2.25-kc tuned amplifier, or readout meter. The performance of the main power and bias batteries can be checked by performing the battery checkout procedure listed in paragraph 4-3. The performance of the SHORT circuit, the reference signal source, and tuned amplifier can be checked by performing the out-of-circuit transistor beta test and the leakage-current test (paragraphs 4-6 and 4-8) using a transistor of known quality. If the cause of the malfunction is determined to be in the reference signal source or the tuned amplifier, employ signal tracing techniques to locate the malfunctioning part. (See figure 1-3.) To obtain access to these circuits it is necessary to disassemble the tester. Refer to paragraph 7-3 for disassembly instructions. When disassembling the tester, use extreme caution to prevent damage to the modules and the loss of mounting hardware.

6-6. CALIBRATION.

6-7. GENERAL.

6-8. Transistor - Diode Tester, Model 219Z should be calibrated after servicing or when it has been in storage for a prolonged period. Since the parts subject to deterioration are only the transistors, the only calibration required is the adjustment of the gain of the tuned amplifier.

6-9. TEST EQUIPMENT REQUIRED.

6-10. The following items are required to calibrate the tester:

a. Multimeter TS-352A/U, or equivalent

b. Two PNP transistors whose beta and I_{CO} are known within 5 percent

c. One NPN transistor whose beta and I_{CO} are known within 5 percent

6-11. STEP-BY-STEP PROCEDURE.

6-12. To adjust the gain of the tuned amplifier and to check the calibration of the tester, proceed as follows:

a. Press interlock switch S6. Readout meter should indicate zero. If not, adjust meter zero set control for zero.

b. Perform battery checkout. (Refer to paragraph 4-3.)

c. Set BIAS SELECTOR switch to OFF position.

d. Connect alligator-clip test probe to IN CIRCUIT PROBE jack.

e. Connect base and emitter leads of probe to PNP transistor of known quality.

f. Connect positive lead of multimeter (TS-352 A/U, or equivalent) to collector of transistor and negative lead of multimeter to collector lead of test probe. Set up multimeter to read 1 milliampere of direct current.

g. Set BETA I_{CO} switch to appropriate beta range.

h. Place PNP-FWD NPN-REV switch in PNP-FWD position.

i. Set BIAS SELECTOR switch for proper collector voltage for test transistor.

j. Adjust RED LINE SET control for 1-milliampere indication on multimeter.

k. A red-line indication should be observed on readout meter. If normal, proceed with step m; if abnormal, proceed with step l.

1. Remove unit from case (paragraph 7-3). Adjust potentiometer R14 (96, figure 9-1) for red-line indication on meter.

m. Disconnect multimeter.

n. Perform out-of-circuit transistor beta test (paragraph 4-6) and leakage-current test (paragraph 4-8) on each of the test transistors. Beta and I_{CO} values should correspond to known values. If not, recheck calibration.

SECTION VII

OVERHAUL INSTRUCTIONS

7-1. SCOPE OF SECTION.

7-2. This section contains disassembly and reassembly instructions for Transistor - Diode Tester, Model 219Z. The tester does not require general overhaul service.

7-3. DISASSEMBLY.

7-4. To disassemble the tester, proceed as follows:

a. Remove cover of tester; place tester on its back on smooth bench surface.

b. Remove the four screws from corners of control panel (1, figure 9-1).

c. Grasping edges of control panel, lift tester clear of case. Place tester on its side on smooth bench surface.

d. To separate control panel and printed circuit board, remove the four screws remaining on front of control panel (61, figure 9-1).

e. To separate battery board and printed circuit board, remove the two screws mounted between batteries BT1 and BT2 and the two screws mounted between batteries BT6 and BT7 (142, figure 9-1).

CAUTION

If it becomes necessary to remove a part from the transistor printed circuit board, use a 25-watt soldering iron and heat only the area where the malfunctioning part is attached to the printed circuit board. When installing transistors, diodes, or precision resistors on a printed circuit board, use a heat sink, such as long-nose pliers, to limit the conduction of heat.

7-5. REASSEMBLY.

7-6. The procedure for reassembling the transistor-diode tester is the reverse of that provided for disassembly.

SECTION VIII

INTRODUCTION TO ILLUSTRATED PARTS BREAKDOWN

8-1. GENERAL.

8-2. The Illustrated Parts Breakdown lists and illustrates the assemblies and detail parts of Transistor-Diode Tester, Model 219Z.

8-3. The Illustrated Parts Breakdown, which is used for identification, requisition, issuance, and storage of parts, comprises this introductory section and Sections IX, X, and XI. Section IX provides a Group Assembly Parts List; Section X, a Numerical Index; and Section XI, a Reference Designation Index.

8-4. GROUP ASSEMBLY PARTS LIST (SECTION IX).

8-5. The Group Assembly Parts List contains a breakdown of the tester into its assemblies, detail parts, and attaching parts. The List is presented in tabular form, with five columns provided for figure and index numbers, part numbers, item descriptions, and units-per-assembly and usable-on-code information.

8-6. FIGURE AND INDEX NUMBER COLUMN.

8-7. The figure and index numbers key the parts breakdown to the applicable illustrations. The

index numbers are assigned in sequence, and generally depict the sequence of disassembly.

8-8. PART NUMBER COLUMN.

8-9. The tester consists of parts procured from a variety of sources; the format of the part numbers differs accordingly. Sierra Electronic Corporation parts are listed by drawing number. Numbers for Government or Industry Standard parts are prefixed with AN, MS, JAN, etc. Parts and hardware items that are available from normal commercial sources and have no definitive part numbers are listed as COMM; assemblies having no part number are so denoted by the expression NO NUMBER in the PART NUMBER column; parts procured from vendors are listed by the vendor's part number.

8-10. Bulk items, such as electrical wiring or cabling, vinyl tubing, sleeving, and lacing cord, are not listed in the PART NUMBER column; parts that have lost identity by being soldered, brazed, welded, riveted, swaged, cemented, potted, sealed, or otherwise permanently fastened to other parts or assemblies, are not listed; further, details of GFP items and vendor assemblies are not listed.

8-11. DESCRIPTION COLUMN.

8-12. The entries in the DESCRIPTION column are indented to show the relationship of parts to their next higher assembly. The description for the first entry begins in column 1; its details appear in column 2. If a column-2 detail is an assembly, its details are shown in column 3, and so forth.

8-13. Attaching parts are listed immediately after the part or assembly they attach, preceding any details of the assembly. The entry "(ATTACHING PARTS)" appears in the DESCRIPTION column immediately preceding the listing of the attaching parts. The symbol "-----*-----" signifies the end of the attaching parts listing.

8-14. Where appropriate, the DESCRIPTION column includes parts description data, i.e., size, tolerance, type, material, etc., and vendor parts data. The vendor data includes the vendor's code number, which is referenced to the vendor's name and address listed in paragraph 8-51. The vendor's code is followed by the Sierra Electronic Corporation control number, if a control number has been assigned.

8-15. UNITS PER ASSEMBLY COLUMN.

8-16. Quantities specified in the UNITS PER ASSEMBLY column are the total number of each part required per assembly and are not necessarily the total number used in the complete equipment. Refer to the QUANTITY PER ARTICLE column, Section X, for total quantities in the complete equipment. For bulk items, the symbol "AR" appears in the column to indicate "As Required". The symbol "REF" indicates that the part has been listed and illustrated elsewhere in the breakdown and has been included in its present listing for reference only. The symbol "NP" indicates that the item (part, installation, etc.) is not separately procurable.

8-17. USABLE ON CODE COLUMN.

8-18. The USABLE ON CODE column indicates parts application in relation to the serial-numbered components concerned. The first component manufactured is designated serial number 1, and subsequent components are numbered consecutively. For parts that are applicable to all configurations of the equipment, the USABLE ON CODE column is left blank. For parts that are applicable only to certain components, a code letter designating the effectivity is noted in the column. A usable-on-code list, relating code letter to component effectivity, precedes the corresponding parts listing in Section IX.

8-19. NUMERICAL INDEX (SECTION X).

8-20. The Numerical Index lists all significant part numbers. The listing provides cross-index data on the stock number and basic data on the quantity per article and the source code.

8-21. PART NUMBER COLUMN.

8-22. The part numbers are listed in alpha-numerical sequence. Parts for which no part number is listed in Section IX (commerical items, parts that do not require a part number, and parts for which the part number was not available at the time of handbook preparation) are listed by their identifying noun. Detail parts that cannot be requisitioned individually but that can be requisitioned by ordering the next higher assembly are so designated by the symbol "NHA". The part number is listed in the column with the symbol "NHA" followed by the number of the next higher assembly.

8-23. STOCK NUMBER COLUMN.

8-24. The stock number consists of two parts: a class code prefix and a serial or FIIN number. The class code designates an equipment category; the serial or FIIN number identifies the part.

8-25. FIGURE AND INDEX NUMBER COLUMN.

8-26. The FIGURE AND INDEX NUMBER column lists the figure and index numbers assigned in the Group Assembly Parts List to associated part numbers. If parts are not indexed in the Group Assembly Parts List, only the associated figure number is shown.

8-27. SOURCE CODE COLUMN.

8-28. Source codes indicate the most practicable source of supply for parts and the applicable level of maintenance. The levels of maintenance include Organization, Field, and Depot.

8-29. RECOVERABILITY CODE COLUMN.

8-30. The information in the RECOVERABILITY CODE column indicates whether the parts are not economically repairable or are economically repairable at a major rework activity.

8-31. EXPLANATION OF SOURCE CODES.

8-32. The following source code definitions are derived from BUWEPS INST 4423.2:

a. A-SERIES: ASSEMBLE-ASSEMBLY NOT PURCHASED.

(1) AF: Applied to assemblies that are not purchased but that are to be assembled with activities prior to installation. At least one of the items in the assembly must be coded as a P-series item, which carries an individual part number and description.

(2) AO: Applied to assemblies that are not purchased but that are to be assembled within overhaul/rework activities prior to installation. At least one of the items in the assembly must be coded as a P-series item, which carries an individual part number and description. There is no anticipated maintenance requirement for the item.

b. M-SERIES: MANUFACTURE — ITEMS NOT PURCHASED.

(1) MF: Applied to items that are capable of being manufactured within fleet activities. Items coded "MF" have either no anticipated usage or restrictive installation or storage factors.

(2) MO: Applied to items that are capable of being manufactured within overhaul/rework activities. Items coded "MO" have no anticipated usage, relatively low usage, or else possess restrictive installation or storage factors.

c. N-SERIES: NOT STOCKED—WILL BE PURCHASED ON DEMAND. Applied to items that do not meet established criteria for stocking and that normally are readily available from commercial sources.

d. P-SERIES: ITEMS PURCHASED. P1: Applied to items that are purchased in view of known or anticipated usage and that are difficult to manufacture within the Navy.

e. U-SERIES: PARTS NOT PROCURED, MANUFACTURED, OR STOCKED. Applied to items that are not of supply or maintenance stocking significance.

f. X-SERIES.

(1) X1: Applied to items for which purchase of the next larger assembly that is source-coded in the P-series is justified.

(2) X2: Applied to items that are not purchased for stock but that may be acquired for use through salvage or one-time purchase. Activities requiring such items will attempt to obtain them from salvage; if neither obtainable from salvage nor readily manufactured, such items will be requisitioned through normal supply channels with supporting justification. Repeated requests may justify a change to the P-series code.

8-33. DEFINITION OF MAINTENANCE CODE.

8-34. Maintenance Codes, as applied to purchased items, are codes that reflect known or anticipated usage at specific levels of maintenance. Maintenance Code "O" indicates Class "A" or "B". Maintenance Code "F" indicates Class "C", "D", "E", or "F". Maintenance Codes shall be omitted from end-item support equipment.

8-35. DEFINITION OF RECOVERABILITY CODE.

8-36. Recoverability Codes are codes that reflect the recoverability characteristics of items removed from equipment at time of maintenance, repair, or overhaul.

Code	Application of Code
C	Consumable: Items that are not considered economically repairable.
D	Code "D" is applied to end items of support equipment that are economical and practical to repair on a scheduled basis at a major rework activity.

8-37. CODE FORMAT.

8-38. In assigning Source, Maintenance, and Recoverability Codes, the following sequence shall be used:

a. Wherever practicable, three-part codes shall be assigned to purchased items:

(1) Source Code.

(2) Maintenance Code: Code "F" when requirements are known or anticipated at "C", "D", "E", or "F" levels of maintenance, and/or Maintenance Code "O" when requirements are known or anticipated at "A" or "B" levels of maintenance.

(3) Recoverability Code.

b. Two-part codes shall be assigned to end-item support equipment:

(1) Source Code.

(2) Recoverability Code.

c. Two-part codes shall be assigned to Navy manufactured and/or assembled items:

(1) Source Code.

(2) Maintenance Code: Code "F", indicating manufacture or assembly by "C", "D", "E", or "F" levels of maintenance, or Maintenance Code "O" when manufacture or assembly is restricted to "A" or "B" levels of maintenance.

8-39. GOVERNMENT STANDARD PARTS.

8-40. Government standard items, such as "AN" hardware and standard electrical wires, gears, resistors, and capacitors, are under normal inventory stock control for unrestricted procurement. These items are not source-coded.

8-41. REFERENCE DESIGNATION INDEX (SECTION XI).

8-42. Section XI contains a listing of all significant reference designators assigned to parts used in this equipment. The reference designators used are assigned, in general, in accordance with MIL-STD-16. The listing also provides cross-index data for the figure and index number, stock number, and part number for the part in question.

8-43. REFERENCE DESIGNATION COLUMN.

8-44. The REFERENCE DESIGNATION column lists the significant reference description symbols in alpha-numerical sequence. This list contains all reference designators shown on schematic diagrams and text in Operating, Service, Maintenance, or Overhaul Handbooks pertaining to the equipment covered by this Illustrated Parts Breakdown.

8-45. FIGURE AND INDEX NUMBER COLUMN.

8-46. The FIGURE AND INDEX NUMBER column contains the Group Assembly Parts List figure and index number assigned to the reference-designated items.

8-47. STOCK NUMBER COLUMN.

8-48 The STOCK NUMBER column contains the class code and stock numbers, where assigned, for parts that have been listed in the REFERENCE DESIGNATION column.

8-49. PART NUMBER COLUMN.

8-50. The PART NUMBER column lists the part numbers of those parts listed in the REFERENCE DESIGNATION column.

8-51. VENDORS' CODES, NAMES, AND ADDRESSES.

8-52. The following list is a compilation of the vendors' codes, names, and addresses of suppliers for purchased and vendor parts listed in Section IX of this handbook.

Code	Vendor's Name and Address
01698	Bronson Tool and Die Co. Bronson, Mich.
03508	General Electric Co. Semi-Conductor Products Dept. of Electronic Components Div. of Electronic, Atomic and Defense Systems Group Syracuse, N. Y.
03615	Ohmite Mfg. Co. Los Angeles, Calif.
04387	Dale Products, Inc. Pacific Division Burbank, Calif.
07589	Argonne Electronics Mfg. Corp. New York, N. Y.
21192	Excelsior Hardware Co. Stamford, Conn.

Code	Vendor's Name and Address
24446	General Electric Co. Schenectady, N.Y.
49956	Raytheon Mfg. Co. Waltham, Mass.
56289	Sprague Electric Co. North Adams, Mass.
71279	Cambridge Thermionic Corp. Cambridge, Mass.
72653	General Cement Division of Textron, Inc. Rockford, Ill.
72982	Erie Resistor Corp. Erie, Pa.
73293	Hughes Products Division of Hughes Aircraft Co. Los Angeles, Calif.
78189	Shakeproof Division of Illinois Tool Works Elgin, Ill.
81074	Holub Industries, Inc. Sycamore, Ill.
82389	Switchcraft, Inc. Chicago, Ill.
82767	Philco Corp. Mount Clemens, Mich.
83330	Smith, Herman H., Inc. Brooklyn, N.Y.
86684	RCA Electron Tube Division of Radio Corp. of America Harrison, N.J.
88044	Aeronautical Standards Group, Departments of Navy and Air Force, Washington, D.C.
91662	Elco Corp. Philadelphia, Pa.
93427	Bendix Aviation Corp. Brooklyn, N.Y.
93519	General Electric Co. Large Lamp Department of Lamp Division of Consumer Products Group Oakland, Calif.
94668	Sierra Electronic Corp. Menlo Park, Calif.
96214	Texas Instruments, Inc. Apparatus Division Dallas, Texas
97707	Noris Instruments, Ltd. New York, N.Y.
99217	Southern Electronics Co. Burbank, Calif.

SECTION IX

GROUP ASSEMBLY PARTS LIST

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
9-1-	219Z	TESTER, TRANSISTOR-DIODE.	1	
	SA-12150-3	. CASE ASSEMBLY; 94668 (121503000)	1	
		(ATTACHING PARTS)		
-1	MS35221-43	. SCREW, MACHINE; 96906 (800004204).	4	
		----*----		
-2	42N	. . CATCH, LUGGAGE; 21192 (918000002)	1	
		(ATTACHING PARTS)		
-3	MS35221-26	. . SCREW, MACHINE; 96906 (800004160)	4	
		----*----		
-4	2111-A	. . HANDLE, BOW; 71279 (918100008)	1	
		(ATTACHING PARTS)		
	MS35221-63	. . SCREW, MACHINE; 96906 (800004255)	2	
	AN960-10	. . WASHER, FLAT; 88044 (816504042).	2	
		----*----		
-5	SU-12089-1	. . CLIP ASSEMBLY; 94668 (120891000)	1	
		(ATTACHING PARTS)		
-6	MS35221-26	. . SCREW, MACHINE; 96906 (800004160)	4	
		----*----		
	SP-13741-3	. . LEAD SET, TEST; 94668 (137413000)	1	
-7	SP-13741-3-1	. . . LEAD,TEST; 94668 (137413001)	1	
-8	33-342	. . . . CLIP, ELECTRICAL; 72653 (916500007) . . .	3	
-9	PT06A-8-3P	. . . . CONNECTOR, PLUG, ELECTRICAL;		
		93427 (914800039).	1	
-10	SP-13741-3-2	. . . LEAD, TEST; 94668 (137413002)	1	
-11	SP-11982-2-2	. . . . CLIP, ELECTRICAL; 94668 (119822022) . . .	3	
-12	PT06A-8-3P	. . . . CONNECTOR, PLUG, ELECTRICAL;		
		93427 (914800039).	1	
-13	SP-12088-1	. . RETAINER, DATA BOOK; 94668 (120881000). . . .	1	
		(ATTACHING PARTS)		
-14	MS35221-12	. . SCREW, MACHINE; 96906 (800004083).	2	
		----*----		
-15	950100003	. . DATA BOOK; 94668 (950100003).	1	
-16	B-1245LH	. . HINGE, BUTT; 01698 (918200004).	2	
		(ATTACHING PARTS)		
-17	AN340-4	. . NUT, PLAIN, HEXAGON; 88044 (808004007)	4	
-18	MS35237-19	. . SCREW, MACHINE; 96906 (800304083).	4	
-19	MS35237-22	. . SCREW, MACHINE; 96906 (800304086).	4	
-20	AN935-4L	. . WASHER, LOCK; 88044 (819204019).	4	
		----*----		
-21	SP-14243-1	. . SPRING PLATE, CLIP; 94668 (142431000)	1	
-22	SP-14244-2	. . CLIP, DATA BOOK; 94668 (142442000)	1	
-23	SP-14242-1	. . BACK PLATE, CLIP; 94668 (142421000).	1	
-24	SP-14241-2	. . SPRING, INTERLOCK OPERATE;94668 (142412000) .	1	
	SP-13578-3	. . PAD, CUSHIONING; 94668 (135783000)	1	
-25	SP-12750-3	. . COVER, TEST SET; 94668 (127503000)	1	
-26	SP-12749-3	. . CASE, TEST SET; 94668 (127493000)	1	
-27	SP-16883-2	. . PLATE, IDENTIFICATION; 94668	1	

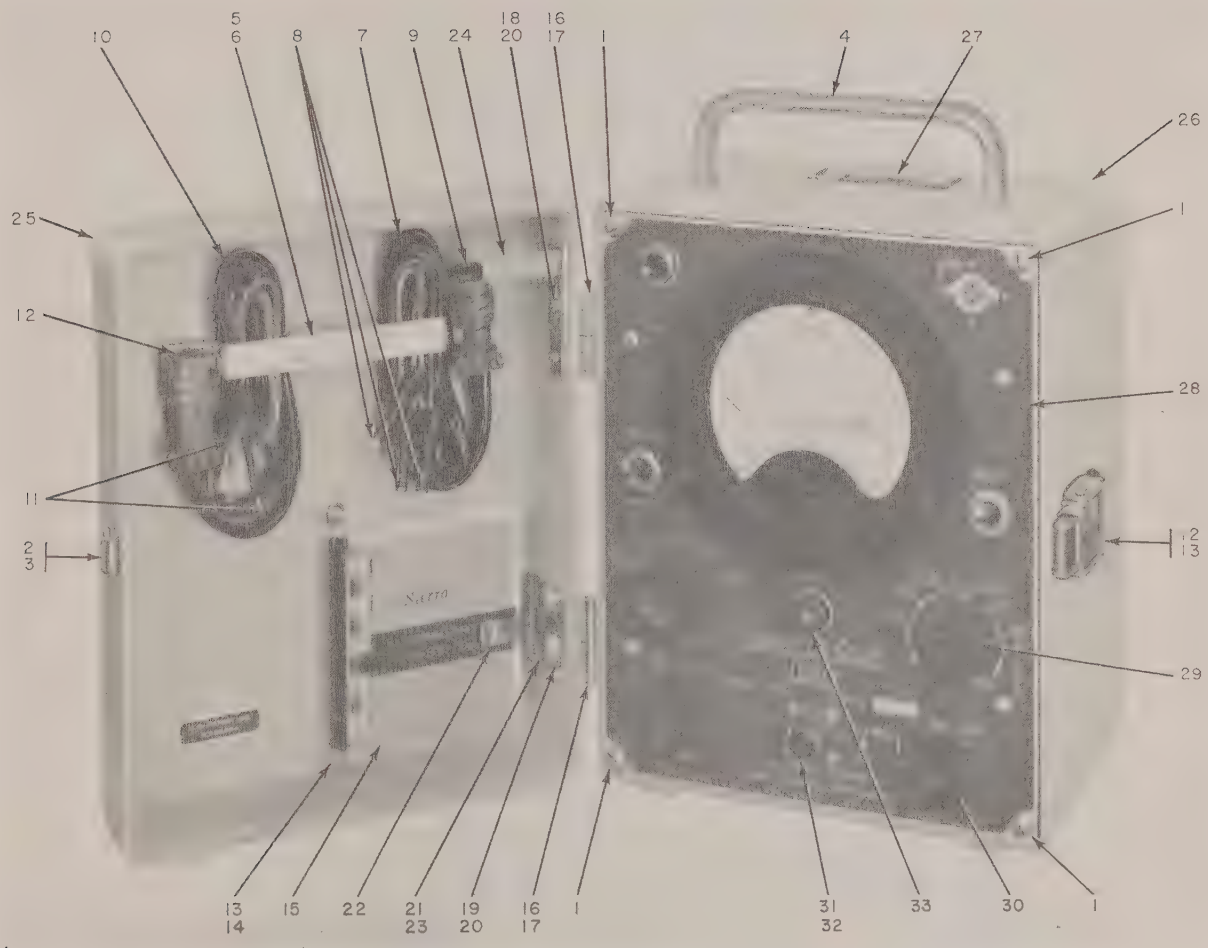

Figure 9-1. Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 1 of 5, Index No. 1 thru 33)

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
9-1-28	SA-15780-3	. TESTER ASSEMBLY; 94668 (157803000)	1	
-29	70-5-2G	. . KNOB; 49956 (916000033)	3	
-30	70-2-2G	. . KNOB; 49956 (916000032)	1	
-31	PT02-A-8-3S	. . CONNECTOR, RECEPTACLE; 93427 (914800040). . (ATTACHING PARTS)	1	
-32	MS35221-13	. . SCREW, MACHINE; 96906 (800004084) . . . . . ----*----	4	
-33	331	. . LAMP, INCANDESCENT, 1.3-volt, 0.06-ampere, midget flange; 93519 (913800006)	1	
-34	ED. 005	. . CAPACITOR, FIXED, CERAMIC, 0.005 μf ±20%, 500 VDCW; 72982 (901410502).	1	
-35	SS-12567-3	. . MULTIMETER, REPLACEMENT, 50-microampere ±2%, 3000-ohm ±20%; 94668 (911800030) . . .	1	
-36	3301	. . SOCKET, SEMICONDUCTOR DEVICE, flat saddle; 91662 (914200027) . . . . . (ATTACHING PARTS)	1	
-37	AN340-2	. . NUT, PLAIN, HEXAGON; 88044 (808004003). . . .	2	
-38	MS35221-3	. . SCREW, MACHINE; 96906 (800004029)	2	
-39	AN935-2	. . WASHER, LOCK; 88044 (819204017). . . . . ----*----	2	
-40	NF4005	. . SWITCH, PUSH, 2-pole, 2-position, 3-AMP, 120-VAC; 82389 (911300003)	1	
-41	MS35059-23	. . SWITCH, TOGGLE, DPDT; 96906 (911000012) . . .	1	
-42	RC20GF470K	. . RESISTOR, FIXED, COMPOSITION, 47-ohm ±10%, 1/2w; 81349 (905200470)	1	
-43	RC20GF820K	. . RESISTOR, FIXED, COMPOSITION, 82-ohm ±10%, 1/2w; 81349 (905200820)	1	
-44	SS-13462-2	. . SWITCH, ROTARY, 6-pole, 5-position, 3-section; 94668 (911200050)	1	
-45	SS-13461-2	. . SWITCH, ROTARY, 3-pole, 2-position, 1-section; 94668 (911200049)	1	
-46	RC20GF390K	. . RESISTOR, FIXED, COMPOSITION, 39-ohm ±10%, 1/2w; 81349 (905200390)	1	
-47	RC20GF100K	. . RESISTOR, FIXED, COMPOSITION, 10-ohm ±10%, 1/2w; 81349 (905200100)	1	
-48	L14005BAM	. . LAMPHOLDER, MINIATURE FLANGE; 97707 (914200020)	1	
-49	SS-14239-1	. . RESISTOR, VARIABLE, 2.5K ±30%, 2w; 94668 (907900114)	1	
-50	RS-2-15	. . RESISTOR, FIXED, WIREWOUND, 15-ohm ±3%, 3w; 04387 (906100007).	1	
-51	RS-2-5	. . RESISTOR, FIXED, WIREWOUND, 5-ohm ±1%, 3w; 04387 (906100004).	1	
-52	RS-2-1.5	. . RESISTOR, FIXED, WIREWOUND, 1.5-ohm ±1%, 3w; 04387 (906100009).	1	
-53	RS-2-0.5	. . RESISTOR, FIXED, WIREWOUND, 0.5-ohm ±3%, 3w; 04387 (906100005).	1	
-54	RC20GF331K	. . RESISTOR, FIXED, COMPOSITION, 330-ohm ±10%, 1/2w; 81349 (905200331)	1	
-55	RC20GF472K	. . RESISTOR, FIXED, COMPOSITION, 4.7K ±10%, 1/2w; 81349 (905200472)	1	

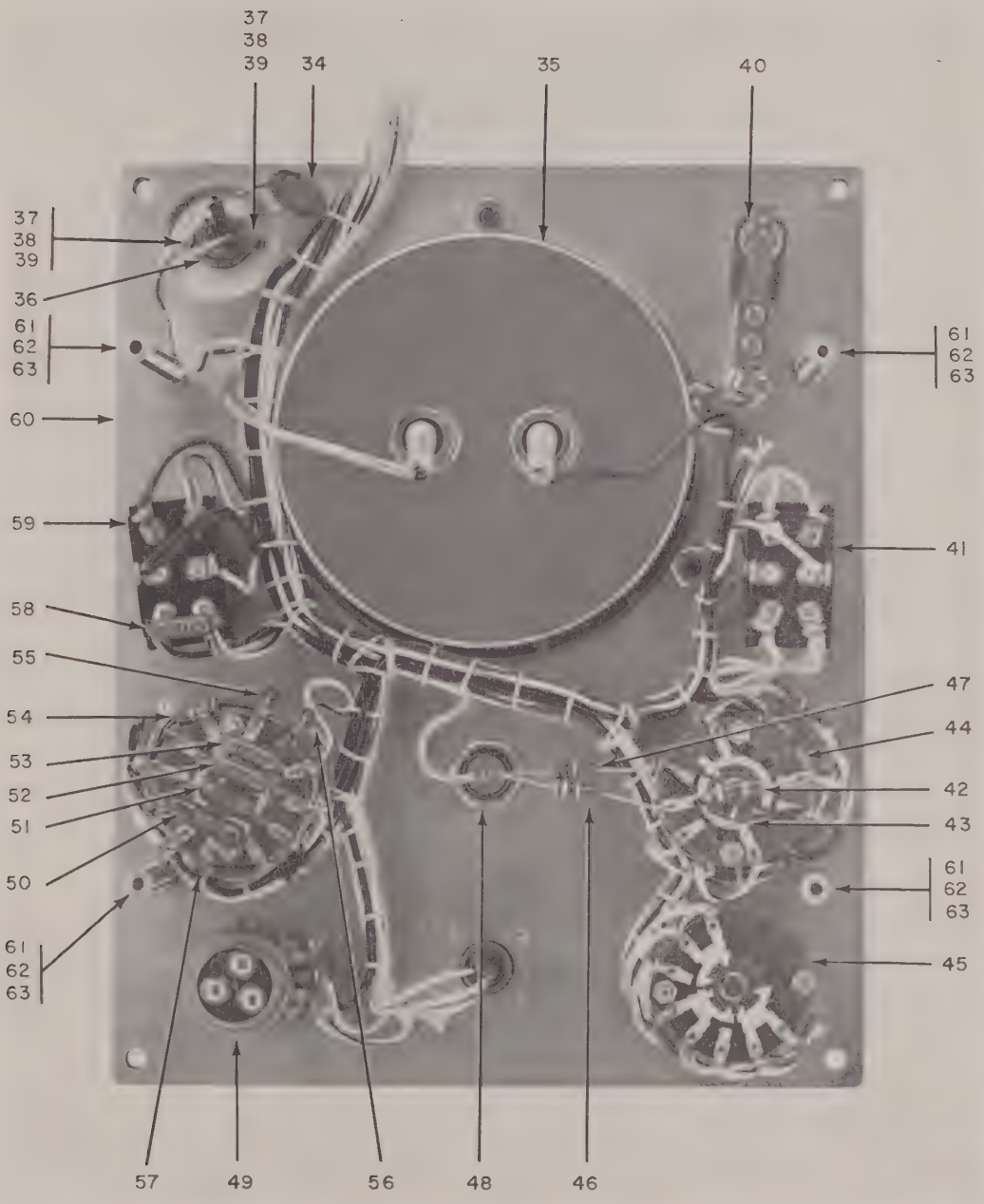

Figure 9-1. Transistor-Diode Tester, Model 219Z, Parts Identification (Sheet 2 of 5, Index No. 34 thru 63)

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
9-1-56	RC20GF473K	. . RESISTOR, FIXED, COMPOSITION, 47K ±10%, 1/2 w; 81349 (905200473)	1	
-57	SS-13460-2	. . SWITCH, ROTARY, 6-pole, 6-position, 3-section; 94668 (911200048)	1	
-58	RS-2-0.5	. . RESISTOR, FIXED, WIREWOUND, 0.5-ohm ±3%, 3 w; 04387 (906100005)	1	
-59	MS35059-26	. . SWITCH, TOGGLE, DPDT, 1-position momentary; 96906 (911000010)	1	
-60	SP-13220-3	. . PANEL, FRONT; 94668 (132203000)	1	
		(ATTACHING PARTS)		
-61	MS35221-28	. . SCREW, MACHINE; 96906 (800004162)	4	
-62	AN936A6	. . WASHER, LOCK; 88044 (819104004)	4	
		----*----		
	SP-12950-4	. . COMPONENT BOARD ASSEMBLY; 94668 (129504000)	1	
		(ATTACHING PARTS)		
-63	SP-12758-1	. . NUT, SLEEVE; 94668 (127581000)	4	
		----*----		
-64	SCM226BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 22 µf ±20%, 15 VDCW; 96214 (902740226)	1	
-65	SCM226BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 22 µf ±20%, 15 VDCW; 96214 (902740226)	1	
-66	MC105H5AT	. . . CAPACITOR, FIXED, MYLAR, 1 µf ±2%, 50 VDCW; 99217 (901130105)	1	
-67	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-68	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-69	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-70	196P22351S2	. . . CAPACITOR, FIXED, PAPER, 0.022 µf ±5%, 100 VDCW; 56289 (901030223)	1	
-71	G1F27AB164	. . . CAPACITOR, FIXED, MYLAR, 0.15 µf ±20%, 100 VDCW; 24446 (901140154)	1	
-72	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-73	MC105H5AT	. . . CAPACITOR, FIXED, MYLAR, 1 µf ±2%, 50 VDCW; 99217 (901130105)	1	
-74	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-75	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-76	G1F27AB164	. . . CAPACITOR, FIXED, MYLAR, 0.15 µf ±20%, 100 VDCW; 24446 (901140154)	1	
-77	MC105H5AT	. . . CAPACITOR FIXED, MYLAR, 1 µf ±2%, 50 VDCW; 99217 (901130105)	1	
-78	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-79	G1F27AB164	. . . CAPACITOR, FIXED, MYLAR, 0.15 µf ±20%, 100 VDCW; 24446 (901140154)	1	
-80	SCM106BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 10 µf ±20%, 15 VDCW; 96214 (902740106)	1	
-81	SCM226BP01	. . . CAPACITOR, FIXED, ELECTROLYTIC, TANTALUM, 22 µf ±20%, 15 VDCW; 96214 (902740226)	1	
-82	1N191	. . . SEMICONDUCTOR, DIODE, Germanium; 73293 (910600191)	1	

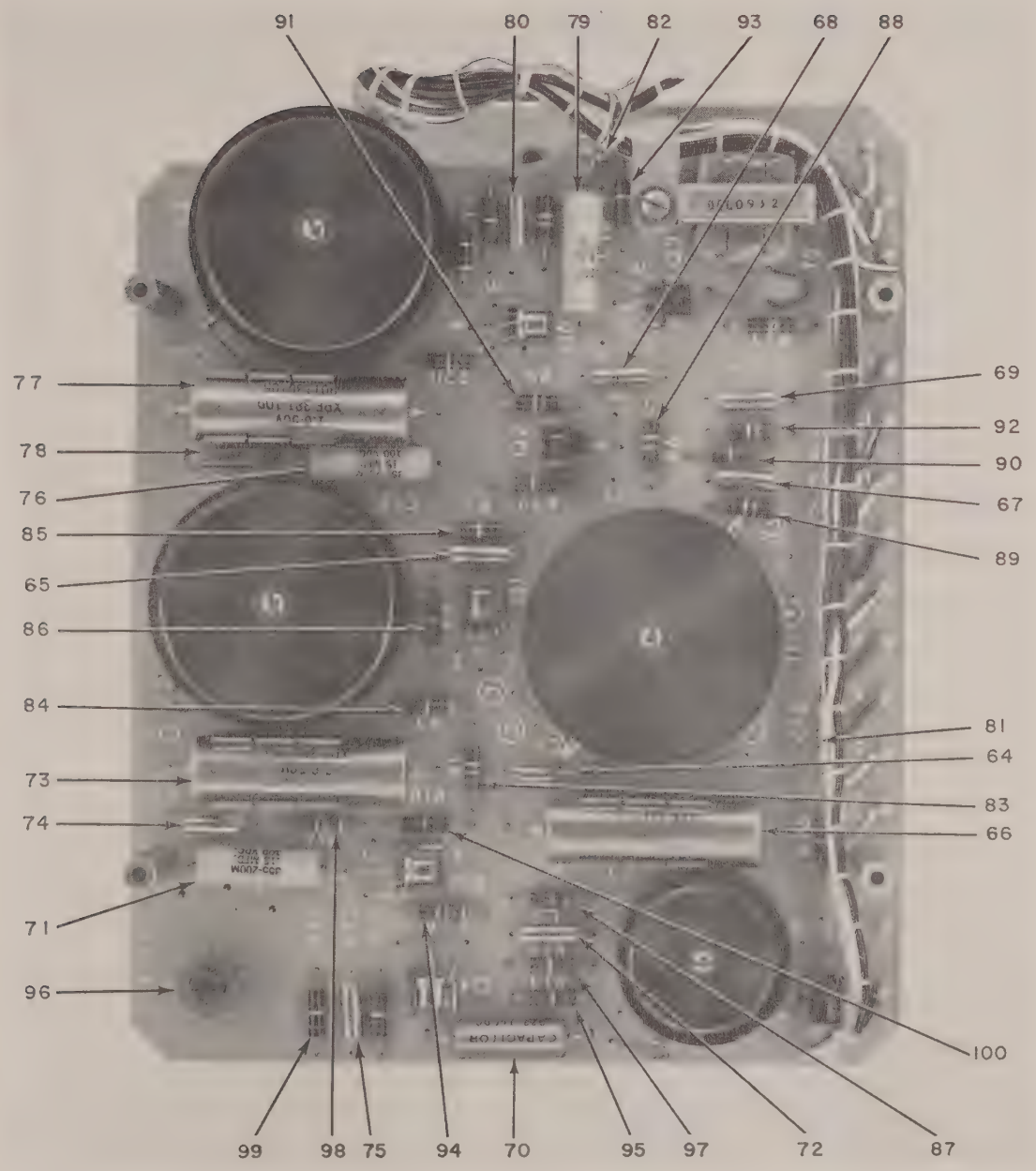

Figure 9-1. Transistor-Diode Tester, Model 219Z, Parts Identification
(Sheet 3 of 5, Index No. 64 thru 100)

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
9-1-83	RC20GF183K	. . . RESISTOR, FIXED, COMPOSITION, 18K ±10%, 1/2 w; 81349 (905200183)	1	
-84	RC20GF472K	. . . RESISTOR, FIXED, COMPOSITION, 4.7K ±10%, 1/2 w; 81349 (905200472)	1	
-85	RC20GF102K	. . . RESISTOR, FIXED, COMPOSITION, 1K ±10%, 1/2 w; 81349 (905200102)	1	
-86	RC20GF101K	. . . RESISTOR, FIXED, COMPOSITION, 100-ohm ±10%, 1/2 w; 81349 (905200101)	1	
-87	RC20GF332K	. . . RESISTOR, FIXED, COMPOSITION, 3.3K ±5%, 1/2 w; 81349 (905200332)	1	
-88	RC20GF123K	. . . RESISTOR, FIXED, COMPOSITION, 12K ±10%, 1/2 w; 81349 (905200123)	1	
-89	RC20GF123K	. . . RESISTOR, FIXED, COMPOSITION, 12K ±10%, 1/2 w; 81349 (905200123)	1	
-90	RC20GF152K	. . . RESISTOR, FIXED, COMPOSITION, 1.5K ±10%, 1/2 w; 81349 (905200152)	1	
-91	RC20GF123K	. . . RESISTOR, FIXED, COMPOSITION, 12K ±10%, 1/2 w; 81349 (905200123)	1	
-92	RC20GF123K	. . . RESISTOR, FIXED, COMPOSITION, 12K ±10%, 1/2 w; 81349 (905200123)	1	
-93	RC20GF152K	. . . RESISTOR, FIXED, COMPOSITION, 1.5K ±10%, 1/2 w; 81349 (905200152)	1	
-94	RC20GF473K	. . . RESISTOR, FIXED, COMPOSITION, 47K ±10%, 1/2 w; 81349 (905200473)	1	
-95	RC20GF562K	. . . RESISTOR, FIXED, COMPOSITION, 5.6K ±10%, 1/2 w; 81349 (905200562)	1	
-96	CLU5021	. . . RESISTOR, VARIABLE, 5K ±10%, 2 w; 03615 (907900106)	1	
-97	RC20GF681K	. . . RESISTOR, FIXED, COMPOSITION, 680-ohm ±10%, 1/2 w; 81349 (905200681)	1	
-98	RC20GF473K	. . . RESISTOR, FIXED, COMPOSITION, 47K ±10%, 1/2 w; 81349 (905200473)	1	
-99	RC20GF562K	. . . RESISTOR, FIXED, COMPOSITION, 5.6K ±10%, 1/2 w; 81349 (905200562)	1	
-100	RC20GF562K	. . . RESISTOR, FIXED, COMPOSITION, 5.6K ±10%, 1/2 w; 81349 (905200562)	1	
-101	RC20GF681K	. . . RESISTOR, FIXED, COMPOSITION, 680-ohm ±10%, 1/2 w; 81349 (905200681)	1	
-102	RC20GF183K	. . . RESISTOR, FIXED, COMPOSITION, 18K ±10%, 1/2 w; 81349 (905200183)	1	
-103	RC20GF472K	. . . RESISTOR, FIXED, COMPOSITION, 4.7K ±10%, 1/2 w; 81349 (905200472)	1	
-104	RC20GF822K	. . . RESISTOR, FIXED, COMPOSITION, 8.2K ±10%, 1/2 w; 81349 (905200822)	1	
-105	RC20GF561K	. . . RESISTOR, FIXED, COMPOSITION, 560-ohm ±10%, 1/2 w; 81349 (905200561)	1	
-106	RC20GF103K	. . . RESISTOR, FIXED, COMPOSITION, 10K ±10%, 1/2 w; 81349 (905200103)	1	
-107	RC20GF274K	. . . RESISTOR, FIXED, COMPOSITION, 270K ±10%, 1/2 w; 81349 (905200274)	1	
-108	RC20GF680K	. . . RESISTOR, FIXED, COMPOSITION, 68-ohm ±10%, 1/2 w; 81349 (905200680)	1	
-109	SS-10821-1	. . . REACTOR, Toroidal, 225 mh ±10%; 94668 (909000090)	1	
		(ATTACHING PARTS)		
-110	510-061810-01	. . . NUT; 78189 (809401011)	1	

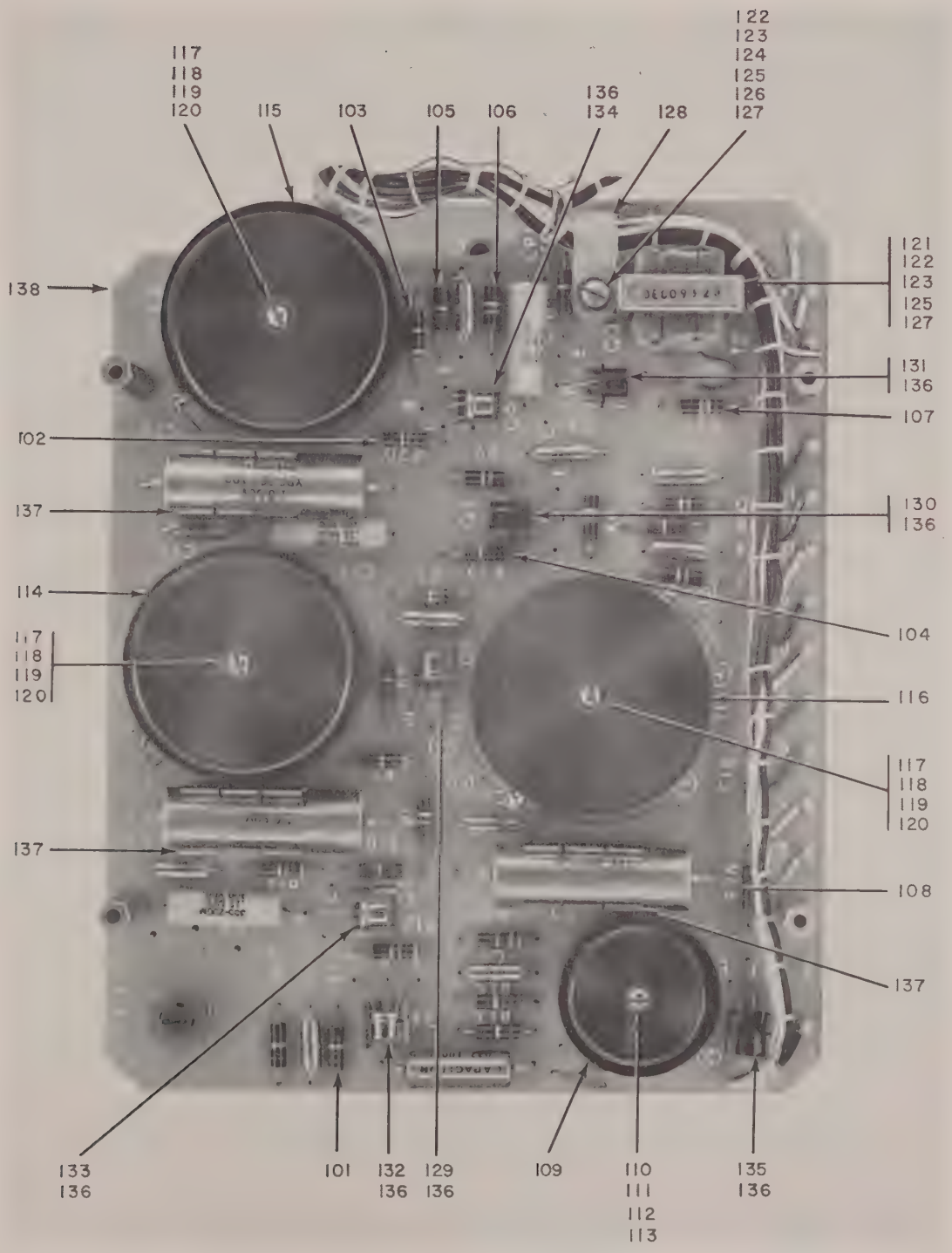

Figure 9-1. Transistor-Diode Tester, Model 219Z, Parts Identification
(Sheet 4 of 5, Index No. 101 thru 138)

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
9-1-111	AN515PB6-18	. . . SCREW, MACHINE; 88044 (800101174)	1	
-112	6513	. . . WASHER, NONMETALLIC; 72653 (816825027).	3	
-113	AN960-6	. . . WASHER, FLAT; 88044 (816501026)	1	
		----*----		
-114	SS-10820-1	. . . REACTOR, Toroidal, 5 mh ±1%; 94668 (909000091)	1	
-115	SS-10820-1	. . . REACTOR, Toroidal, 5 mh ±1%; 94668 (909000091)	1	
-116	SS-12688-1	. . . TRANSFORMER, AUDIO FREQUENCY, toroidal, 20 mh ±10% primary; 94668 (909300002).	1	
		(ATTACHING PARTS)		
-117	510-061810-01	. . . NUT; 78189 (809401011)	1	
-118	AN515PB6-22	. . . SCREW, MACHINE; 88044 (800101175)	3	
-119	6513	. . . WASHER, NONMETALLIC; 72653 (816825027) .	9	
-120	AN960-6	. . . WASHER, FLAT; 88044 (816501026)	3	
		----*----		
-121	AR-162	. . . TRANSFORMER, POWER, ISOLATION; 07589 (910000034)	1	
		(ATTACHING PARTS)		
-122	510-041810-01	. . . NUT; 78189 (809401007)	2	
-123	MS35221-15	. . . SCREW, MACHINE; 96906 (800001086)	1	
-124	MS35221-19	. . . SCREW, MACHINE; 96906 (800001092)	1	
-125	6513	. . . WASHER, NONMETALLIC; 72653 (816825027) .	2	
-126	2100	. . . SPACER, SLEEVE; 83330 (915800005)	1	
-127	AN960-4	. . . WASHER, FLAT; 88044 (816501014)	5	
		----*----		
-128	22XX62603	. . . CLAMP, LOOP; 82767 (915300020)	1	
-129	2N404	. . . TRANSISTOR; 86684 (910300007)	1	
-130	2N527	. . . TRANSISTOR; 03508 (910300006)	1	
-131	2N527	. . . TRANSISTOR; 03508 (910300006)	1	
-132	2N404	. . . TRANSISTOR; 86684 (910300007)	1	
-133	2N404	. . . TRANSISTOR; 86684 (910300007)	1	
-134	2N404	. . . TRANSISTOR; 86684 (910300007)	1	
-135	2N527	. . . TRANSISTOR; 03508 (910300006)	1	
-136	SP-12511-3-5	. . . CLIP, SPRING TENSION; 94668 (125113005) .	7	
-137	SP-12511-3-7	. . . CLIP, SPRING TENSION; 94668 (125113007) .	3	
-138	SP-12948-4	. . . PRINTED CIRCUIT BOARD; 94668 (129484000)	1	
-139	SB-12459-2	. . BATTERY, Mercury, 2.7-, 5.4-, and 12.1-volt taps, 1000 MAH; (918500001)	1	
-140	SB-12460-2	. . BATTERY, Mercury, 4.05-volt, 3600 MAH; (918500002)	6	
	SP-12951-4	. . CLIP ASSEMBLY; 94668 (129514000).	1	
-141	SP-12090-1	. . . SPACER, ROD; 94668 (120901000)	4	
		(ATTACHING PARTS)		
-142	MS35221-28	. . . SCREW, MACHINE; 96906 (800004162)	4	
-143	AN936A6	. . . WASHER, LOCK; 88044 (819104004)	4	
		----*----		
-144	SP-11267-2-1	. . . CLIP, ELECTRICAL; 94668 (112672001) . . .	2	
-145	SP-11267-2-2	. . . CLIP, SPRING TENSION; 94668 (112672002) .	14	
-146	SP-11508-2	. . . CONTACT, ELECTRICAL; 94668 (115082000) .	14	
-147	SP-11260-2-1	. . . CLIP, SPRING TENSION; 94668 (112602001) .	2	
-148	SP-11260-2-2	. . . CLIP, SPRING TENSION; 94668 (112602002) .	4	
-149	EC-4	. . . CLAMP, LOOP; 81074 (915300014).	1	
		(ATTACHING PARTS)		

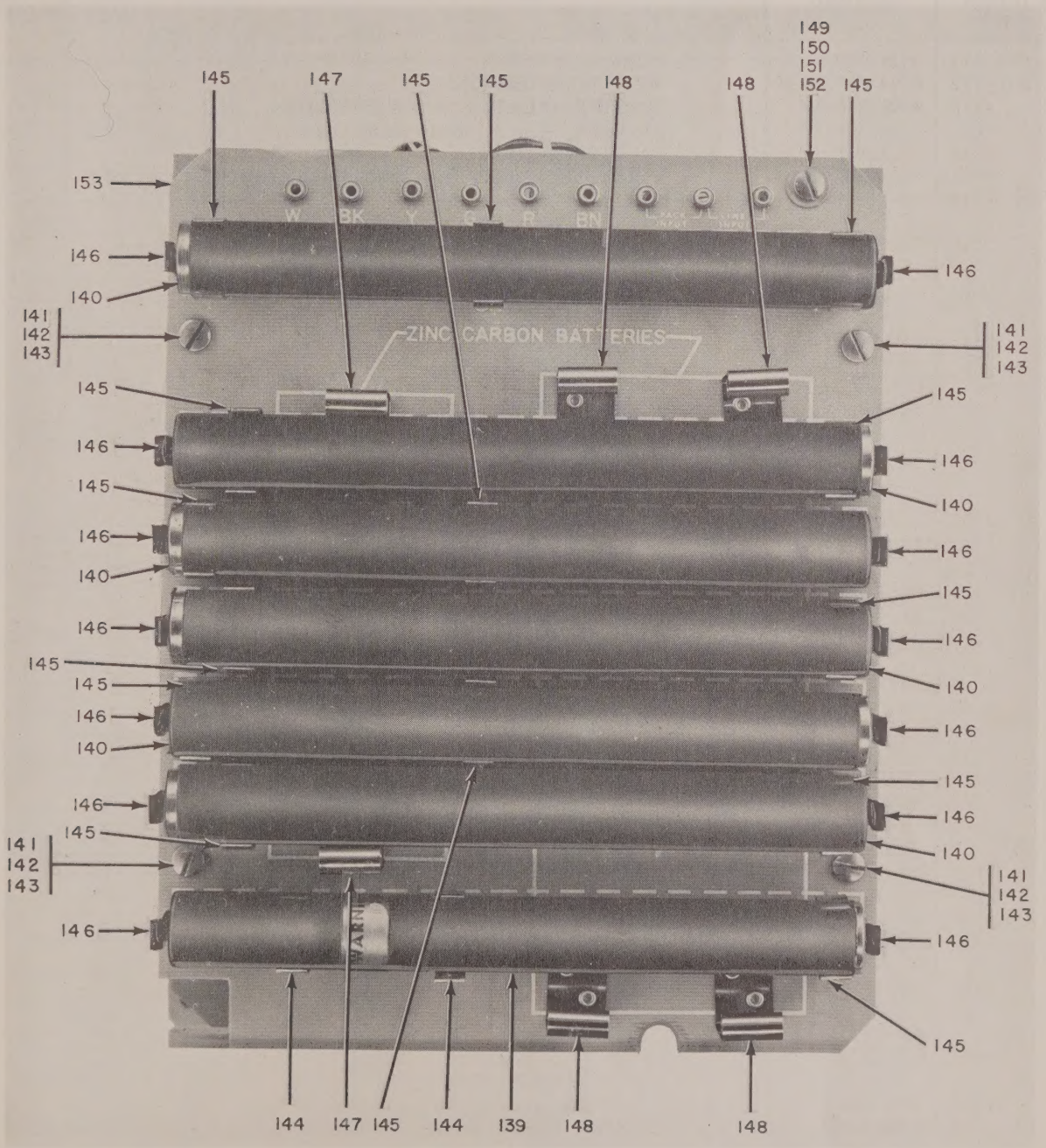

Figure 9-1. Transistor-Diode Tester, Model 219Z, Parts Identification
(Sheet 5 of 5, Index No. 139 thru 153)

FIG. AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
9-1-150	510-061810-01	. . . NUT; 78189 (809401011)	1	
-151	MS35221-30	. . . SCREW, MACHINE; 96906 (800004164)	1	
-152	AN960-6	. . . WASHER, FLAT; 88044 (816501026)	2	
		----*----		
-153	SP-13028-4	. . . PRINTED CIRCUIT BOARD;94668 (130284000) .	1	

SECTION X

NUMERICAL INDEX

PART NO.	STOCK NO. CLASS CODE	STOCK NO. SERIAL OR PART NO.	FIGURE AND INDEX NO.	SOURCE CODE	RECOV CODE
AN340-2			9-1-37		
AN340-4			-17		
AN515PB6-18			-111		
AN515PB6-22			-118		
AN935-2			-39		
AN935-4L			-20		
AN936A6			-62		
			-143		
AN960-4			-127		
AN960-6			-113		
			-120		
			-152		
AN960-10					
AR-162			-121		
B-1245LH			-16		
CLU5021			-96		
EC-4			-149		
ED.005			-34		
G1F27AB164			-71		
			-76		
			-79		
L14005BAM	RM6220	815-5350-E212	-48	P1	C
MC105H5AT			-66		
			-73		
			-77		
MS35059-23			-41		
MS35059-26			-59		
MS35221-3			-38		
MS35221-12			-14		
MS35221-13			-32		
MS35221-15			-123		
MS35221-19			-124		
MS35221-26			-3		
			-6		
MS35221-28			-61		
			-142		
MS35221-30			-151		
MS35221-43			-1		
MS35221-63					
MS35237-19			-18		
MS35237-22			-19		
NF4005			-40		
PT-20A-8-3S			-31		
PT06A-8-3P			-9		
			-12		
RC20GF100K			-47		
RC20GF101K			-86		
RC20GF102K			-85		
RC20GF103K			-106		
RC20GF123K			-88		
			-89		
			-91		
			-92		
RC20GF152K			-90		
			-93		
RC20GF183K			-83		
			-102		
RC20GF274K			-107		
RC20GF331K			-54		
RC20GF332K			-87		
RC20GF390K			-46		
RC20GF470K			-42		
RC20GF472K			-55		
			-84		
			-103		
RC20GF473K			-56		
			-94		
			-98		
RC20GF561K			-105		
RC20GF562K			-95		
			-99		
			-100		
RC20GF680K			-108		
RC20GF681K			-97		
			-101		
RC20GF820K			-43		
RC20GF822K			-104		
RS-2-0.5			-53		
			-58		
RS-2-1.5			-52		
RS-2-15			-50		

PART NO.	STOCK NO. CLASS CODE	STOCK NO. SERIAL OR PART NO.	FIGURE AND INDEX NO.	SOURCE CODE	RECOV CODE
RS-2-5			9-1-51		
SA-12150-3					
SA-15780-3			-28		
SB-12459-2			-139		
SB-12460-2			-140		
SCM106BP01			-67		
			-68		
			-69		
			-72		
			-74		
			-75		
			-78		
			-80		
SCM226BP01			-64		
			-65		
			-81		
SP-11260-2-1			-147		
SP-11260-2-2			-148		
SP-11267-2-1			-144		
SP-11267-2-2			-145		
SP-11508-2			-146		
SP-11982-2-2	RM5940	566-0664-E212	-11		
SP-12088-1			-13		
SP-12090-1			-141		
SP-12511-3-5			-136		
SP-12511-3-7			-137		
SP-12749-3			-26		
SP-12750-3			-25		
SP-12758-1			-63		
SP-12948-4			-138		
SP-12950-4					
SP-12951-4					
SP-13028-4			-153		
SP-13220-3			-60		
SP-13578-3					
SP-13741-3					
SP-13741-3-1			-7		
SP-13741-3-2			-10		
SP-14241-2			-24		
SP-14242-1			-23		
SP-14243-1			-21		
SP-14244-2			-22		
SP-16883-2			-27		
SS-10820-1	RM5950	815-3527-E222	-114	P1	C
			-115		
SS-10821-1	RM5950	815-3528-E222	-109	P1	C
SS-12567-3			-35		
SS-12688-1	N5950	856-3120	-116	P1	C
SS-13460-2			-57		
SS-13461-2			-45		
SS-13462-2			-44		
SS-14239-1			-49		
SU-12089-1			-5		
1N191			-82		
196P22351S2			-70		
2N404			-129		
			-132		
			-133		
			-134		
2N527			-130		
			-131		
			-135		
2100			-126		
2111-A			-4		
219Z					
22XX62603			-128		
33-342			-8		
3301			-36		
331	9C6240	228-7130	-33	P1	C
42N			-2		
510-041810-01			-122		
510-061810-01			-110		
			-117		
			-150		
6513			-112		
			-119		
			-125		
70-2-2G			-30		
70-5-2G			-29		
950100003			-15		

SECTION XI

REFERENCE DESIGNATION INDEX

REFERENCE DESIGNATION	FIG. AND INDEX NO.	STOCK NO.		PART NO.
		CLASS CODE	SERIAL OR PART NO.	
BT1	9-1-139			SB-12459-2
BT2	-140			SB-12460-2
BT3	-140			SB-12460-2
BT4	-140			SB-12460-2
BT5	-140			SB-12460-2
BT6	-140			SB-12460-2
BT7	-140			SB-12460-2
C1	-64			SCM226BP01
C2	-65			SCM226BB01
C3	-66			MC105H5AT
C4	-67			SCM106BP01
C5	-68			SCM106BP01
C6	-69			SCM106BP01
C7	-70			196P22351S2
C8	-71			G1F27AB164
C9	-72			SCM106BP01
C10	-73			MC105H5AT
C11	-74			SCM106BP01
C12	-75			SCM106BP01
C13	-76			G1F27AB164
C14	-77			MC105H5AT
C15	-78			SCM106BP01
C16	-79			G1F27AB164
C17	-80			SCM106BP01
C18	-81			SCM226BP01
C19	-34			ED. 005
CR1	-82			1N191
DS1	-33	9C6240	228-7130	331
J1	-31			PT02-A-8-3S
L1	-109	RM5950	815-3528-E222	SS-10821-1
L2	-114	RM5950	815-3527-E222	SS-10820-1
L3	-115			SS-10820-1
M1	-35			SS-12567-3
Q1	-129			2N404
Q2	-130			2N527
Q3	-131			2N527
Q4	-132			2N404
Q5	-133			2N404
Q6	-134			2N404
Q7	-135			2N527
R1	-83			RC20GF183K
R2	-84			RC20GF472K
R3	-85			RC20GF102K
R4	-86			RC20GF101K
R5	-87			RC20GF332K
R6	9-1-88			RC20GF123K
R7	-89			RC20GF123K
R8	-90			RC20GF152K
R9	-91			RC20GF123K
R10	-92			RC20GF123K
R11	-93			RC20GF152K
R12	-94			RC20GF473K
R13	-95			RC20GF562K
R14	-96			CLU5021
R15	-97			RC20GF681K
R16	-98			RC20GF473K
R17	-99			RC20GF562K
R18	-100			RC20GF562K
R19	-101			RC20GF681K
R20	-102			RC20GF183K
R21	-103			RC20GF472K
R22	-104			RC20GF822K
R23	-105			RC20GF561K
R24	-106			RC20GF103K
R25	-107			RC20GF274K
R26	-108			RC20GF680K
R27	-49			SS-14239-1
R28	-58			RS-2-0.5
R29	-50			RS-2-15
R30	-51			RS-2-5
R31	-52			RS-2-1.5
R32	-53			RS-2-0.5
R33	-46			RC20GF390K
R34	-47			RC20GF100K
R35	-56			RC20GF473K
R36	-54			RC20GF331K
R37	-43			RC20GF820K
R38	-42			RC20GF470K
R39	-55			RC20GF472K
S1	-57			SS-13460-2
S2	-45			SS-13461-2
S3	-41			MS35059-23
S4	-59			MS35059-26
S5	-44			SS-13462-2
S6	-40			NF4005
T1	-116	N5950	856-3120	SS-12688-1
T2	-121			AR-162
XDS1	-48	RM6220	815-5350-E212	L14005BAM
XQ1	-36			3301